Grundlagen der Spieleprogrammierung

Teil I: 3D-Graphik

Kapitel 5: Modellierung und Drahtgitter

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Outline

1. Übersicht und Motivation
2. Mathematische Grundlagen
3. Das Ideal: Photorealistisch (Raytracing, Radiosity)
4. Die Realität: DirectX und OpenGL (Übersicht)
5. Schritt 1: Modellierung und Drahtgitter
6. Schritt 2: Texturen
7. Schritt 4: Licht, Filter, etc.
8. Schritt 5: Fortgeschrittene Techniken (Vertex-, Pixel-Shader, …)
9. 3D-Hardware
10. 3D-Engines im Überblick, Cg von nvidia
11. Spielekonsolen
12. Zusammenfassung und Ausblick

Grundsätzliches

- Initialisierung
  - Wahl der gewünschten Hardware
  - Wahl des Treibers
  - Konfiguration (Vollbild, …)
- Beschreibung der 3D-Szene
  - Nutzung vorhandener Primitive (Box, Sphere, …)
  - Nutzung der Basisabstraktionen (Dreieck, …)

Namespaces

Microsoft.DirectX	This namespace provides utility operations and data storage for DirectX application programming, including exception handling, simple helper methods, and structures used for matrix, clipping plane, quaternion, and vector manipulation.
Microsoft.DirectX.AudioVideoPlayback	The AudioVideoPlayback application programming interface (API) provides for basic playback and simple control of audio and video files.
Microsoft.DirectX.Diagnostics	The DirectX Diagnostics application programming interface (API) enables you to programmatically query the information gathered by the DirectX Diagnostics Tool (DxDiag).
Microsoft.DirectX.Direct3D	Microsoft Direct3D® is a low-level graphics API that enables you to manipulate visual models of 3-D objects and take advantage of hardware acceleration.
Microsoft.DirectX.DirectDraw	Microsoft DirectDraw® enables you to directly manipulate display memory, the hardware blitter, hardware overlay support, and flipping surface support.
Microsoft.DirectX.DirectInput	Microsoft DirectInput® is used to process data from a keyboard, mouse, joystick, or other game controller.
Microsoft.DirectX.DirectPlay	DirectPlay enables you to write network applications such as multiplayer games.
Microsoft.DirectX.DirectPlay.Lobby	Microsoft DirectPlay® Lobby enables a DirectX application to interact with an application hosted on a remote server.
Microsoft.DirectX.DirectPlay.Voice	DirectPlay Voice provides media-independent network transport and client management, but it does not duplicate DirectPlay session control features.
Microsoft.DirectX.DirectSound	Microsoft DirectSound® provides a system to capture sounds from input devices and play sounds through various playback devices using advanced 3-D positioning effects, and filters for echo, distortion, reverberation, and other effects.
Microsoft.DirectX.Security	Controls permissions related to Direct3D, DirectInput, DirectPlay, and DirectSound.
Microsoft.DirectX.Security.Permissions	Allows security actions to be applied to code using declarative security.

Microsoft.DirectX

Classes

DirectXException	Root exception class for all DirectX exceptions.
DXHelp	Miscellaneous helper functions for Managed DirectX
MatrixStack	Applications use the methods of the MatrixStack object to manipulate a matrix stack

Structures

Matrix	Describes a matrix.
Plane	Describes a plane.
Quaternion	Describes a quaternion.
Single16	
Vector2	Describes a vector in two-dimensional (2-D) space.
Vector3	Describes a vector in three-dimensional (3-D) space.
Vector4	Describes a vector in four-dimensional (4-D) space.

Devices

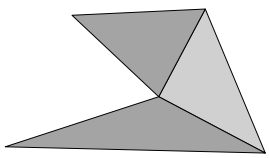
- Hardware
  - Unterstützung durch Hardware
- Software
- Referenz
  - Reine Software-Implementierung
  - Betonung der Funktionalität
  - Effizienz nebensächlich
  - Meist nur auf einem Entwicklungssystem zugänglich

Zugang zu einem Device

- Manager-Objekt (manager)
  - Suche nach geeignetem Adaptor
  - Adapator = eigene HW
  - Z.B. Dual-Head-Karte hat zwei Adaptoren
- Property: AdapterListEnumerator (Adaptors)
  - Durchlaufen und nach Adapter mit gewünschten Eigenschaften suchen
- Capabilities
  - Stimmen Fähigkeiten des Geräts mit meinen Anforderungen überein

Knotenverarbeitung

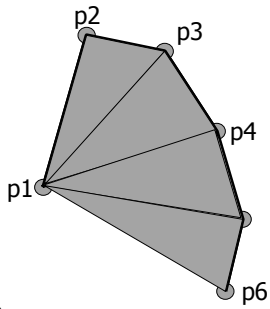
- Primitive setzen sich aus Einzelpunkten zusammen
  - Dreiecke (3 Punkte)
  - Polygonzug
  - Box (8 Punkte)
- Punkte werden häufig mehrfach verwendet
  - z.B. jeder Punkt einer Box taucht in 6 Dreiecken auf

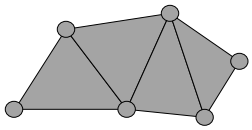


- Wo werden Knoten gespeichert und bearbeitet?
  - SoftwareVertexProcessing: Standardisiert
  - HardwareVertexProcessing: Kartenabhängig
  - MixedVertexProcessing

Primitive

- Knotenpuffer (Vertex Buffer)
  - p1, p2, p3, p4, p5, p6, ...
- Interpretation:
  - Point List: p1, p2, p3, …
  - Line List: (p1,p2), (p3,p4), …
  - Line Stripe: (p1,p2), (p2,p3), (p3,p4), …
  - Triangle List: (p1,p2,p3), (p4,p5,p6), …
  - Triangle Stripe: (p1,p2,p3), (p2,p3,p4), (p3,p4,p5), …
  - Triangle Fan: (p1,p2,p3),(p1,p3,p4), (p1,p4,p5), …





Allgemeine Vorgehensweise

- Anlegen und Füllen eines VertexBuffer
  - Variable Informationen pro Knoten
- VertexBuffer mit Device verbinden
  - `device.SetStreamSource()`
- Zeichnen
  - ```
    device.BeginScene()
    device.DrawPrimitives(Type,FirstVertex,#Vertex)
    …
    device.EndScene()
    device.Present() // Darstellen
    ```
    ```

Welche Informationen pro Knoten

- Spezielle Klasse CustomVertex

Structures

Show: Structures

Structure	Description
PositionColored	Custom Vertex Format structure containing position and diffuse color.
PositionColoredTextured	Custom Vertex Format structure containing position, diffuse color, and one set of texture coordinates.
PositionNormal	Custom Vertex Format structure containing position and normal data.
PositionNormalColored	Custom Vertex Format structure containing position, normal data, and diffuse color.
PositionNormalTextured	Custom Vertex Format structure containing position, normal data, and one set of texture coordinates.
PositionOnly	Custom Vertex Format structure containing position only.
PositionTextured	Custom Vertex Format structure containing position and one set of texture coordinates.
Transformed	Custom Vertex Format structure containing transformed vertices.
TransformedColored	Custom Vertex Format structure containing transformed vertices and diffuse color.
TransformedColoredTextured	Custom Vertex Format structure containing transformed vertices, one set of texture coordinates, and diffuse color.
TransformedTextured	Custom Vertex Format structure containing transformed vertices, and one set of texture coordinates.